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IMPLEMENTATION COMPLETION REPORT

REPUBLIC OF KOREA

PUSAN AND TAEJON SEWERAGE PROJECT
(Loan 3450-KO)

DECEMBER 16, 1996

Infrastructure Operations Division
Country Department I
East Asia and Pacific Region

CURRENCY EQUIVALENTS

Currency Unit - Won (W)

Average used in appraisal estimates (July 1991): US$ = W 720

Actual yearly average market values:

US$ = W 780 1992
US$ = W 802 1993
US$ = W 803 1994
US$ = W 770 1995
US$ = W 805 1996

WEIGHTS AND MEASURES

1 meter (m)	= 39.37 inches
1 kilometer (km)	= 1,000 meters or 0.62 mile
1 square meter (m2)	= 10.8 square feet
1 square kilometer (km2)	= 0.38 square mile
1 hectare (ha)	= 10,000 square meters or 2.47 acres
1 cubic meter (m3)	= 1,000 liters or 264 US gallons
1 liter (l)	= 0.26 US gallon
1 liter per capita per day (lcd)	= 0.26 US gallons per capita per day
1 million liters per day (Mld)	= 1,000 cubic meters per day
1 metric ton (t)	= 1,000 kilograms or 2,205 pounds

FISCAL YEAR OF BORROWER

January 1 to December 31

ABBREVIATIONS AND ACRONYMS

BOD	-	Biochemical Oxygen Demand
EMP	-	Environmental Monitoring Program
FRR	-	Financial Rate of Return
MOCT	-	Ministry of Construction and Transportation
MOE	-	Ministry of Environment
MOFE	-	Ministry of Finance and Economy
NGO	-	Non-Governmental Organization
NWIP	-	National Water Improvement Program
NWTP	-	National Wastewater Treatment Plan
SSA	-	Sewerage Special Account
SS	-	Suspended Solids
SMP	-	Sewerage Master Plan
WTP	-	Wastewater Treatment Plant

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Preface

This is the Implementation Completion Report (ICR) for the Pusan and Taejon Sewerage Project in the Republic of Korea, for which loan No. 3450-KO in the amount of US$ 40 million equivalent was approved on March 26, 1992 and made effective on August 26, 1992.

The loan closed on June 30, 1996 compared with the original closing date of December 31, 1995. Out of the total loan, an amount of US$ 6.0 million was canceled in July 1994 by Pusan, and US$ 0.46 million canceled in December 1995 by Taejon. The final disbursement took place in September 19, 1996, at which time a balance of US$ 19.6 thousand equivalent was canceled.

The ICR was prepared by the Infrastructure Operations Division, Country Department I, East Asia and Pacific Region and reviewed by Mr. J.Shivakumar, Chief of Infrastructure Operations, and Mr. Walter Schwermer, Project Adviser.

Preparation of this ICR began during the Bank's completion mission, in November 1996. The borrower contributed to preparation of the ICR by preparing its own evaluation of the project's execution and initial preparation which is attached in Appendix A and B. The borrower also commented on the draft ICR.

Implementation Completion Report

REPUBLIC OF KOREA

Pusan and Taejon Sewerage Project
(Loan 3450-KO)

Evaluation Summary

Introduction

i. The project was designed to support the Korean Government's efforts to improve water quality in rivers and coastal waters, and was a logical continuation of the Bank's Sewerage and Wastewater Sector Report (1988) in which the main recommendations were to increase construction of wastewater treatment plants (WTP), and to accelerate conversion of combined sewers. Through the project preparation the Bank drew on its familiarity with the Korean water supply and sewerage sector, its experience in supporting sector developments worldwide, and its interest in addressing environmental issues.

Project Objectives

ii. The objectives of the project were to: (a) improve environmental conditions in two of Korea's largest cities; (b) reduce pollution in the country's rivers and coastal waters, which is crucial to the well-being of a large part of the population; (c) reduce health hazards associated with contaminated water bodies, particularly to the lowest-income section of the population which is most exposed to this problem; and (d) provide continued support for technological and institutional improvements in the sector.

iii. In Pusan, the project consisted of the construction of the first phase of Nambu (previously called Yongho) WTP, a sewage pumping station and about 11.4 km of large-diameter interceptors. In Taejon, the project consisted of construction of the second phase of Wonchon Dong WTP and 11.9 km of interceptors.

iv. During project identification a review was made of the existing Pusan and Taejon sewerage master plans (SMP), which were already over ten years old and did not provide sufficient detail to further develop the systems. It was agreed that both project cities would update their SMPs by December 31, 1992 to take into account any developments since the plans were prepared, and to establish programs for conversion to more sanitary and environmentally acceptable separate sewer systems.

v. The WTPs constructed under the project were part of the plan for further expansion of treatment capacity and sewer construction projects. As the improvement of environmental conditions was a main objective of the project, assurances were obtained that the actual performance of the constructed plants would be monitored to ensure compliance with environmental regulations as well as to provide useful data for future expansion programs. Both cities agreed to implement an Environmental Monitoring Program (EMP) to collect and evaluate the impact of plant operations.

vi. The financial viability of the two implementing agencies, Pusan and Taejon sewerage division, depended upon the ability to generate adequate income to meet all financial obligations on a timely basis and sustain a

satisfactory level of working capital to continue operations. To this end both cities agreed to set sewerage tariffs yielding adequate revenues to meet operation and maintenance costs including depreciation, and to provide a rate of return of at least 5% in Pusan and 3% in Taejon on their respective net revalued fixed assets. The rate of return covenants were used to measure the financial performance of both cities' sewerage facility. Due to national anti-inflationary policies, sewerage tariffs were not increased in 1992 or 1993, and the rates of return targets were not achieved (para 17-21).

vii. The project objectives supported the Korean Government's 1990-96 National Wastewater Treatment Plan (NWTP) to improve the water quality in the country, and reverse environmental degradation due to the country's rapid industrialization. The planning was sound and the results would suggest that the project was well founded and the agreements reached to promote the achievement of the objectives were realistic and well conceived.

Implementation Experience and Results

viii. The project achieved its overall objectives. The identification phase was carried out in a very satisfactory manner. The feasibility studies and detailed design benefitted not only from the extensive involvement of local agencies, but also from the evaluation of issues by infrastructure and environmental units within the Bank. There is strong evidence that the project is sustainable, given the commitment of national and local governments to improve environmental conditions in the country, and Pusan and Taejon have recently advanced their investment programs for additional wastewater treatment facilities.

ix. The only delay in implementation was in Pusan where the WTP is located close to a residential area. Neighboring resident representatives held lengthy discussions with the city to ensure that the appearance and operation of the completed plant would not adversely affect their living conditions. This matter was resolved by a partial redesign of the component which was satisfactory to the residents.

x. The project's cost, including interest during construction, as estimated at appraisal was US$ 272.1 million of which US$ 40.0 million equivalent was to be financed by the Bank. The balance was financed from local borrowing, the cities' general accounts, internal cash generation, and a small capital contribution from the central government to Taejon city towards the international Expo'93 exhibition. The original closing date was set at December 31, 1995, but due to the delay in implementation in Pusan, the closing date was extended to June 30, 1996. The actual project cost was US$ 278.6 million which is only fractionally higher than the appraisal estimate.

xi. A number of institutional strengthening initiatives were implemented under the project to update the cities' SMPs, provide operator training during start-up and commissioning, provide guidance on sewerage tariff structures, and improve environmental monitoring. Overall Bank supervision was satisfactory, being handled by an experienced sanitary engineer, supported by environmental and financial specialists. The borrower and implementing agencies performed well and relations with these agencies and consultants were cordial and productive.

xii. The financial performance of both project cities was, however, unsatisfactory. This was mainly due to the delay in raising sewerage charges which, during appraisal had been expected to be increased in 1992, but due to national anti-inflationary measures, this did not happen. However, substantial

additional tariff increases were introduced in Pusan in 1995 and an additional increase of over 30% is planned for 1997. This is not the case in Taejon where relatively small increases of 9.8% were introduced in 1994 and 1996, but these were insufficient to make the agency profitable. Taejon has been designated a spill-over city for Seoul, and keeping charges at lower levels is a factor in encouraging development in this area. (para. 21 & 25)

xiii. Actual revenues in 1995 were 30% less than projected during appraisal in Pusan, and 40% less in Taejon. Another reason for the unsatisfactory financial performance and reduced revenues was lower water consumption due to very low rainfall for the past three years. A water conservation campaign introduced mainly in Pusan, resulted in lower billing than originally projected.

xiv. On balance, the project outcome can be considered satisfactory. The only major problem was the failure to increase sewerage tariffs as had been expected during appraisal, and the non-compliance of the financial ROR covenants. Although the financial covenants were not complied with, at project completion the overall target for internally generated funds had been satisfactorily addressed in Pusan. In Taejon, increase in sewerage tariffs has been at lower levels to encourage development in the city. The loss of revenue due to lower tariffs did not affect the financing of the project as the shortfall was made up from the cities' general account and local borrowing.

Summary of Findings, Future Operations, and Key Lessons Learned

xv. Benefits from the project will be sustained given the cities' and government's commitment to improve the environment, and their provision of skilled and well trained staff to service and operate the facilities. This commitment is also supported by the citizens of Pusan and Taejon (paras 24-25). Both cities will continue to monitor environmental conditions at the plants and the receiving waters.

xvi. The main lessons to be drawn from the experience in implementing the project are as follows:

a) the close relationship between the Bank and the borrower provided the basis for wide-ranging discussions, not only to create appropriately designed projects, but also for provision of well trained institutions to support and operate the facilities, environmental monitoring, and the ability of operating agencies to further develop the systems.

b) where sewerage facilities are located close to residential areas, discussions should be held at an early stage with residents' representatives to reach acceptable plant design standards, as well as tolerable methods of operation; failure to do this can lead to construction delays.

c) as an alternative to using the rate of return covenant to measure satisfactory financial performance of a sewerage utility where assets are mainly underground, out of sight and difficult to value, an acceptable measure is the agency's contribution to investment from internal resources; this covenant was adopted for the follow-up sewerage project in Pusan (Korea: Waste Disposal Project Ln.3830-KO).

d) the potential for the success of any project is increased if it fits into the government's sector development policy.

Implementation Completion Report

REPUBLIC OF KOREA

Pusan and Taejon Sewerage Project
(Loan 3450-KO)

PART 1: PROJECT IMPLEMENTATION ASSESSMENT

A. Project Objectives

1. Korea experienced a sharp upsurge in economic growth during the past three decades, which was accompanied by an increased demand for water supplies for domestic and industrial use. The outlook for the next decade is for continued expansion in the demand for water. The treatment and safe disposal of wastewater is a major concern of the government, and to help resolve this problem, the National Water Improvement Program (NWIP) was approved by government in 1989.

2. The two key elements in the NWIP were the upgrading of municipal water supplies and the improvement of water quality in rivers and coastal waters. The NWIP was formulated with the assistance of the Bank report Korea - Sewerage and Wastewater Management, Options and Recommendations (April 1988), and the objectives of the Pusan and Taejon Sewerage Project conform to this program.

3. The aim of the development of sewerage systems in the two project cities by 2001 is to provide the total population with sewerage services, including full secondary treatment of all wastewater generated in the planning area. The objectives of the project were to: (a) improve environmental conditions; (b) reduce pollution in the water courses and coastal waters; (c) reduce health hazards associated with contaminated rivers; and (d) continue to support technological and institutional improvements in the sector.

4. The project objectives were well defined, realistic and important for the sector development, and had the full commitment of the Pusan and Taejon city governments and their respective sewerage agencies.

5. The Pusan component of the project consisted of the construction of the first phase of the Nambu (previously called Yongho) waste water treatment plant (WTP), a sewage pumping station and 11.4 km of large-diameter interceptors. The Taejon component consisted of the construction of the second phase on Wonchon Dong WTP and 11.9 km of interceptors.

6. The Pusan Sewerage Management Office, and the Taejon Sewerage Division already had considerable experience in implementing similar projects, and were satisfactorily assisted by consultants throughout the preparation, implementation and commissioning periods. There were no undue risks as the professional ability and extensive work experience of the agencies' staff enabled them to respond to changes occurring during implementation.

B. Achievement of Project Objectives

Physical Objectives

7. The design of all project components represented the least-cost solution to improve sewerage systems in Pusan and Taejon, and the resulting construction was carried out successfully.

8. In Pusan the construction of the Nambu (previously known as Yongho in the SAR) WTP was completed in June 1996, but the final completion of the sea outfall is not expected until October 1997. Test operations commenced on November 1, 1995 and were completed in May, 1996. At appraisal, construction of civil works, the installation of equipment, commissioning and testing, were planned to be completed on December 31, 1994.

9. Due to objections from neighboring NGOs on the visual and operational effect the WTP would have on the neighborhood, the treatment plant had to be partially redesigned, replacing an open concrete channel on the Daeyon river by a tunnel, and eliminating the booster pumping station on the trunk main. The delay in completion was due to negotiations with NGOs, redesign and new bidding.

10. In Taejon the construction of the second phase of Wonchon Dong sewage treatment plant and the sewer interceptors (increased from 11.9 km at appraisal to 20.7 km) was completed in January 1994, and test operations were finished in July 1994. At appraisal the planned date for completion of construction, commissioning and test operations was December 31, 1993.

11. The actual project cost, including interest during construction, is US$ 278.6 million which is only about 2% higher than the appraisal estimate of US$ 272.1 million. The Bank financed US$ 33.5 million of the project out of the approved loan of US$ 40.0 million (Pusan canceled US$ 6.0 million from savings made on equipment and the partial redesign of the component, and Taejon canceled US$ 0.4 million). The balance of the project cost was financed from local borrowing, the cities' general accounts, and a contribution from the central government to Taejon city towards the Expo'93 exhibition.

Environmental Objectives

12. The successful completion of the project is expected to provide long-term environmental benefits to the two cities and their surrounding areas. These include conservation of aquatic resources, reduced health hazards associated with contaminated water, improved quality of receiving bodies of water, increased land and property values, and enhanced aesthetic appearance of river and coastal recreation areas.

13. The measures taken to reduce negative environmental impact during construction are standard to all construction sites in Korea, and were satisfactorily observed in both cities.

14. The regulations relating to the operation of WTPs, the potential environmental impact and mitigating measures to be taken, are comprehensive in nature, and under MOE regulations, are required to be accurately monitored on a continuous basis. There are no special requirements regarding the operation of interceptors or pumping stations, and the designs for these are satisfactory and environmentally sound.

15. In Pusan, the monitoring contract was modified to reflect the start of the first test operations and full testing commenced in June 1996 when the plant went into full operation. On the city's own initiative a sea environment research program will also be carried out.

16. In Taejon the first monitoring before completion of construction was carried out in November 1993 and January 1994, but due to unsatisfactory results had to be repeated, taking into account other factors such as river flow and depth, and the quantity and characteristics of discharge into the

river. The water quality showed higher concentrations of BOD, COD and SS compared to the values predicted in the 1989 Environmental Impact Assessment study. It is reported that these high concentrations are partly due to Stage III of the Wonchon Dong WTP, which is currently under construction.

Financial Objectives

17. The financial objectives were established so that both cities' sewerage agencies would improve their financial situation in order to progress towards self-financing status in the future, and contribute to funding investments. To support this objective, the two city governments agreed that revenues from sewerage charges would be set to cover operating and maintenance costs including depreciation, and produce annual rates of return of not less than 5% in Pusan and 3% in Taejon. These targets were used as a covenants to measure the financial performance of both cities' sewerage facility.

18. Due to national anti-inflationary policies, the Government opposed any utility tariff increases in 1992 or 1993. In April 1993, these policies were followed by the cities when the authority to set tariffs was devolved to the municipalities, and as a consequence the rates of return targets were not achieved. From 1994, both cities increased the sewerage charge which resulted in an improvement in revenue generation (para 23). This indicates that in spite of the fact that financial covenants were not complied with, the overall target for internally generated funds had been addressed in both cites. The actual rates of return achieved compared to those required at appraisal are shown in Table 1.

Table 1. Rates of return

	Pusan		Taejon	
Year	Required	Actual	Required	Actual
1993	5.0%	1.4%	3.0%	-0.5%
1994	5.0%	1.5%	3.0%	-0.7%
1995	5.0%	2.2%	3.0%	-1.6%
1996 (est)	5.0%	2.9%	3.0%	0.0%

19. The major reasons Pusan sewerage division did not achieve the rate of return target were due to the advancement of its capital expenditure program, the extremely high increases in revalued fixed asset values in 1993, and the reduced volumes of waste water processed. At appraisal the projected capital expenditure for 1995 was W 74 billion whereas the actual figure jumped to W 120 billion as environmental pressures forced the city to bring forward construction of wastewater treatment facilities. The revaluation of fixed assets, covering the five years to 1993, increased fixed asset values by over 85%. Wastewater volumes were 28% below the appraisal estimate due to severe water shortages over the past three years, which resulted in lower than projected revenues.

20. While wastewater volumes were 7% less than projected during appraisal, the main reason Taejon failed to generate sufficient revenues and achieve a positive rate of return is because it failed to increase tariffs to an adequate level. During negotiations, Taejon agreed to take all necessary measures to achieve a rate of return of 3% per annum, and it was expected that tariff increases in the order of 20% to 25% would be required for the period 1992 through 1994 to help meet this target.

21. Once national anti-inflationary pressures were lifted and the authority to set tariffs was devolved to the cities, Taejon city kept annual

sewerage charge increases at under 10%, which were insufficient to achieve the required 3% rate of return. The situation was discussed with Bank missions and it was reported that local political pressures were foremost in keeping tariff increases at lower levels than other special cities in Korea. Taejon has been designated a spill-over city for Seoul, and keeping charges at lower levels in Taejon is a factor in encouraging development in this area to take some of the pressure off the overdevelopment of Seoul.

22. While the financial performance in both project cities has been less than satisfactory, operational expenditure remained as projected, which is a positive indication that the shortfall in revenues has not affected the operation and maintenance expenditure on the facilities. The lower than expected income was made up from the cities' general accounts and local borrowing from the respective regional development funds and Pusan received a W 18 billion loan from the Environmental Development Fund.

Sewerage Tariffs

23. In Pusan, average sewerage tariffs were increased by 9.9% from January 1, 1994, by a further 19.7% from January 1995, and an additional increase of 37.4% in December 1995. In Taejon they were increased by 9.8% in November, 1994 and by the same percentage in June 1996. Additional increases of 34.9% in Pusan and 10% in Taejon are planned to be introduced early in 1997. Both cities have included annual increases of their sewerage tariffs in their respective Five Year Plans from 1997 through to 2001.

24. The recent substantial increases in sewerage tariffs in Pusan have been agreed after a series of discussions between the city and resident organizations, as the improvement of the environment is now a major issue with all citizens. Pusan recently suffered from contamination of the Nakdong river (the main water source for the city), with drought conditions now being into the third year, and 'red-tides' experienced in some of the river estuaries, beaches and coastal areas.

25. The increase in average sewerage tariffs in Taejon has been at a lower levels to encourage development in the city (para 21), and unlike Pusan, the city of Taejon has not experienced the same environmental problems or water shortages. In addition, the city has not needed to generate large revenues from tariffs to fund expansion of its wastewater treatment facilities, as land developers are funding around two-thirds of Phase III of the Wonchon Dong WTP.

Institutional Development

26. Under the project the sewerage master plans (SMP) for both cities were updated with the maximum use of computers to simplify their maintenance, and to update and make amendments as and when required. This updating is designed to ensure that subsequent expansion of wastewater treatment facilities represents best choices and least-cost solutions. Treatment plant operators received training during the commissioning of the new treatment plants, which use the latest technology to ensure optimal performance.

27. The sewerage agencies' finance staff, assisted by consultants, have developed the skills necessary to prepare detailed annual tariff increase submissions. The agencies' aims are to set sewerage tariffs consistent with economic and social objectives and with due consideration of the residents' willingness and ability to pay.

Sector Policies

28. The project has not deviated from the sector policies of the Government as prescribed by the Ministry of Construction and Transportation (MOCT) and the Ministry of Environment (MOE). The completed project therefore, conforms with the detailed designs approved by MOE, and was consistent with government's and Bank's development/country strategy.

Financial Rate of Return

29. The financial rate of return (FRR) of the completed project relates sewerage revenues (adjusted to include approved tariff increases) to the capital and operating costs of sewerage facilities, and is computed as an approximate indication of minimum economic return. The FRR is 7.0% for Pusan and 0.4% for Taejon, as compared to 9.5% and 4.9% respectively at appraisal. These reductions in the FRR are the consequence of the delay in imposing higher sewerage tariffs, as well as reduced billings due to water shortages.

30. The difference in the two cities' FRR is attributed largely to the tariff increases introduced earlier, at higher levels in Pusan than in Taejon (para 23). With regards to Pusan, the matter of tariffs was satisfactorily addressed from 1994 onwards with annual increases averaging over 30%, and considering the social nature of the project with intangible health and environmental benefits, the recalculated FRR is considered adequate. The FRR for Taejon is unsatisfactory. Action needs to be taken by the responsible city officials to remedy the situation of Taejon's sewerage agency and ensure that long-term sustainablity is not threatened.

C. Major factors Affecting the Project

31. Firms of Korean consulting engineers were engaged under the project to supervise day-to-day construction; verify compliance with specifications for works and goods; test and commission completed works; advise on training staff to operate the completed facilities; and prepare procurement documentation. The performance of these consultants for both project components was good and contributed significantly to the successful implementation of the project.

32. The standard of performance of the contractors for civil works, electrical and mechanical work on the treatment plants, interceptors and related tasks was generally good. Performance on equipment supply contracts was satisfactory; deliveries were on schedule, and all equipment supplied conformed to specifications.

33. The clear sector policies, guidelines and local government commitment to both components, together with the significant environmental benefits, were a major factor in the positive results of the project.

34. Both cities provided capital contributions from their general accounts, and the central Government provided equity funding for the Taejon component linked to that city's Expo'93 international exhibition. The Regional Development Funds in both cities provided loans to help finance the project. Pusan also obtained a loan on preferential terms from the Environmental Management Corporation (EMC) which was not expected at the time of the appraisal. Taejon obtained a loan from EMC towards stage III of the Wonchon Dong WTP which is presently under construction.

35. The commitment of the management and staff in Pusan and Taejon sewerage divisions was generally very good and their internal administrative procedures worked satisfactorily. The regular submission of project progress reports was adequate but the submission of managerial and financial monitoring indicators was occasionally delayed, leaving Bank supervision missions to complete some of the data.

36. In Pusan, lower than expected equipment costs coupled with the elimination of the booster pumping station led to a reduction in the project costs of some US$ 6 million. Pusan city initially considered using this amount to help finance an incinerator for the disposal of sludge, but later decided against this course of action and in July 1994, on government request, the Bank loan was reduced from a total of US$ 40 million to US$ 34 million. The partial redesign of the WTP due to objections from neighboring NGOs was the main reason for the delay of about 18 months from the original estimate (para 9).

D. Project Sustainability

37. The project's achievements are likely to be sustainable. The training of operators during test operations ensured transfer of knowledge on the proper maintenance of facilities and assisted the sewerage agency staff in both project cities to plan, design and implement further sewerage projects. Some project benefits, like the protection of water quality and the environment, are being expanded at a national level through the National Water Improvement Program (NWIP).

38. The up-dating of the sewerage master plans will assist in providing as-built drawings of all plant and network, introduce agency staff to the latest technological advances in computerized planning systems, and the detail needed for the cities to manage further development of their wastewater treatment facilities. These generated benefits should help to sustain operations.

39. A potential problem which could threaten sustainability, is failure to continue tariff setting at levels which would allow the two sewerage divisions to operate as self-sufficient public enterprises. Such a failure could result in a reversal of the progress made in encouraging these agencies to follow sound financial practices. The Taejon sewerage division currently operates at a loss and corrective action, including substantial increase in tariffs, is needed to correct the present unsatisfactory situation.

40. The setting of tariffs has political implications, and therefore during the completion mission, both cities confirmed that the shortfall in revenues to finance expansion and cover adequate operation and maintenance of the sewerage facilities, would be made up from the cities' general accounts and local borrowing. Although revenues are less than the projections made during appraisal, there has been no cut-back in providing the necessary funds for operation and maintenance (para 22).

41. To make amends for the failure to increase tariffs to an adequate level during 1992 through 1994, Pusan city held meetings with resident groups to discuss the environmental implications of any delay in providing safe disposal of wastewater. The citizens acknowledged that there is a cost involved in creating a clean environment for themselves and their families, and supported the increase in average sewerage tariffs by 37.4% on January 1, 1996, and are prepared to accept annual increases in the order of 20% p.a.

from 1997 through 2001 (para 24). These annual increases appear in the city's Five Year Plan.

E. Bank Performance

42. The Bank's activities during the preparation, appraisal, negotiation and loan approval stages were satisfactory and thorough, with considerable support provided to the borrower and the implementing agencies. The need for quick implementation of the project was important as the international trade exhibition Expo'93 took place in Taejon between August and November 1993, and the additional sewerage facilities were essential for this important event.

43. The technical alternatives selected for the project were appropriate, and represented the least-cost solution to improve sewerage systems in the project cities. There were no unusual risks, although at appraisal it was recognized that a delay in adequate tariff increases would restrict internal cash generation, which could place a burden on the cities' general accounts. This situation did arise especially in Taejon where additional city resources were needed to support the project.

44. The establishment of sewerage tariffs in Korea is relatively new and it was initially the responsibility of central government to set the rates. Bank staff have provided continuing guidance on sewerage tariff structures and policies to MOCT since the start of the preparation and appraisal process. A government-financed national tariff study was prepared in 1991 which was the basis for MOCT guidelines on the methodology for setting sewerage tariffs, now being used by municipalities which, since project appraisal, have been delegated the authority for approving these charges.

45. Continuity of Bank staff during implementation was highly satisfactory with the same appraisal team also taking part in supervision missions. This continuity was especially important as some of the key staff of the borrower and the implementing agencies changed during implementation.

F. Borrower Performance

46. The performance of the implementing agencies, government ministries and departments, from project preparation through completion was good, as were the technical capabilities of the Pusan and Taejon sewerage agencies, supported by consultants. This is particularly commendable as there were staff changes in several key positions. Delays and unforseen problems with a few components were in most cases due to factors beyond the borrower's and implementing agencies' control.

47. The project's positive environmental impact is confirmation of the cooperation of the Korean authorities, especially MOE. Pusan and Taejon sewerage agencies have implemented Environmental Monitoring Programs (EMP) which meet MOE and the Bank's requirements. For the Taejon component, environmental monitoring is continuing under Stage III of the Wonchon Dong WTP which is already under construction. Pusan city has entered into a contract with the Environmental Research Institute of the Pukyung University in Pusan to provide environmental monitoring. The first report was submitted to the Bank in March 1994 and the final report will be issued once the final results are documented after completion of construction of the sea outfall and outlet, presently expected to be in September 1997.

48. The status of performance on the major covenants in the loan and project agreements is shown in Part II Table 10 of this report. Compliance with these covenants has been satisfactory except for the failure to achieve rate of return targets in both cities.

G. Assessment of Outcome

49. The project results are rated satisfactory. Objectives were achieved, and there is transparent sustainability of the completed facilities. Clear environmental and health benefits have ensued, and developments in treatment plant construction and network extension are already in progress.

50. The institutional developments that took place during the implementation of the project will have a lasting impact on the efficient operation and maintenance of the Pusan and Taejon wastewater facilities. Updating sewerage master plans using modern computer-based technologies, and the streamlining of sub-sector institutions will allow both cities to upgrade the sanitation services they provide.

51. The experience gained in preparing recommendations for tariff negotiations, and the relevance of increased charges on the financial performance of the agency will lead to a greater awareness of the importance of the guidelines established during project appraisal. An annual review of tariff levels is now required, instead of the previous situation whereby tariff levels had remained unchanged since their introduction. While sewerage tariffs were not increased during project implementation to the levels required to meet rate of return targets, both cities have recently raised their average sewerage charges and annual increases are planned for the future (para 23).

H. Future Operation

52. The completed project works will be operated and maintained under the overall supervision of the Pusan and Taejon sewerage agencies. Staff numbers and efficiency are satisfactory and there are less than two employees per thousand sewerage connections in both cities. The maintenance of the combined drainage system is decentralized to the city districts (Gu). WTPs, interceptors and sewage pumping stations are operated and maintained by the respective treatment plant centers.

53. Both sewerage divisions are experienced in satisfactorily operating WTPs similar to the ones constructed under the project, and additional training was provided to operators on the new technologies introduced during the project. The sewerage divisions provide technical guidance and, as required by the budgets of the respective units, allocate funds from Sewerage Special Accounts (SSA) which are managed and administered by the sewerage agencies.

54. The existing allocation of duties and responsibilities is satisfactory and has been extended to the new facilities constructed under the project. Both cities have additional WTPs and sewer interceptors under construction using the SMPs updated as part of the project, and the institutional developments are keeping pace with the growth of the organizations.

55. For wastewater treatment efficiency, and to ensure environmental guidelines are adhered to, the performance of the constructed WTPs will be

continuously monitored for BOD, SS, phosphorus and nitrogen. This monitoring program also applies to new plants already under construction in both cities.

I. Key Lessons Learned

56. A major factor in the success of this project was the active participation by national and city governments in its preparation and implementation, and the close relationship between the Bank and the borrower, which helped to create an appropriately designed project, with experienced agencies to service and operate the completed facilities.

57. The delay in completion of the Pusan component was due to lengthy negotiations with neighboring NGOs over the design and operation of the new WTP. Pusan city now acknowledges that full discussions with all adjacent residents and workers at the earliest opportunity is of paramount importance in order to design plants of an aesthetically acceptable standard, with local amenities or recreation facilities provided if at all possible, and that operating systems should take into account the close proximity of residential areas (para 9).

58. The calculation of the rate of return for the sewerage divisions, relies on a realistic valuation of the sewerage fixed assets (para 19). Due to the inherent difficulty in valuing assets (mainly underground and out of sight), compounded by the volatility of asset values in Korea, it is considered advisable in future to focus on the main concern which is the overall target for internally generated funds. The covenant's objectives promote financial viability, satisfactory financial performance, prudent financial management of the project entity, and supports socio-economic goals. The cash generation covenant was used in the on-going follow-up project (the Waste Disposal Project - Loan 3830-KO)

59. The agreed project Financing Plan required increases in sewerage tariffs to levels that would produce a minimum rate of return. Subsequent national anti-inflationary measures were imposed that restricted the ability of the agencies to make these increases, and assurances were received that the shortfall in revenues would not delay the project, and that adequate funds would be provided for proper operation and maintenance of the facilities (para 18).

60. The potential for the success of any project is increased if it fits into the government's development policy for the sector and can draw on other projects and related studies. In this case the Bank report 'Korea - Sewerage and Wastewater Management, Options and Recommendations (April 1988)' assisted in formulating the National Water Improvement Program (NWIP) which gave clear support for this type of project (para 2).

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IMPLEMENTATION COMPLETION REPORT

PUSAN AND TAEJON SEWERAGE PROJECT (LOAN 3450-KO)

PART II: STATISTICAL TABLES

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Implementation Completion Report

Pusan and Taejon Sewerage Project (Loan 3450-KO)

Table 1: Summary of Assessments

Achievement of Objectives	Substantial	Partial	Negligible	Not Applicable
Macroeconomic policies				X
Sector policies	X			
Financial objectives		X		
Institutional development		X		
Physical objectives	X			
Poverty reduction				X
Gender concerns				X
Environmental objectives	X			
Public sector development		X		
Private sector development				X

Project Sustainability	Likely	Unlikely	Uncertain
	X		

Bank Performance	Highly Satisfactory	Satisfactory	Deficient
Identification		X	
Preparation assistance		X	
Appraisal		X	
Supervision		X	

Borrower Performance			
Preparation		X	
Implementation		X	
Covenant compliance		X	

Assessment of Outcome	Highly Satisfactory	Satisfactory	Un-satisfactory	Highly Un-satisfactory
		X		

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Implementation Completion Report

Pusan and Taejon Sewerage project (Loan 3450-KO)

Table 2: Related Bank Loans

Loan Title	Purpose	Approved	Status
Preceding operations			
First Water Supply Project (Ln 2072-KO)	Expanded water services in five cities	1982	Complete. loan closed 06/30/87 PPAR No.8174, 1989
Second Water Supply Project (Nakdong Barrage Ln 2350-KO)	Eliminated sea water intrusion in Nakdong delta	1984	Complete. loan closed 06/30/89 PCR No. 8675,1990
Third Water Supply Project (Metro Region Ln 2491-KO)	Water supply to 25 municipalities in Seoul Metro region	1985	Complete. loan closed 12/31/90 PCR No. 11530
Fourth Water Supply Project (Namgang & Taegu Ln 2615-KO)	Expanded water services in 14 municipalities	1986	Complete. loan closed 06/30/90 PCR No. 10833
Juam Regional Water Supply Project (Ln 3178-KO)	Provided water services in 9 municipalities	1990	Complete. Loan closed 12/31/94 ICR No. 15783
Following operations			
Kwangju & Seoul Sewerage project Ln 3590-KO	Expand wastewater treatment capacity & reduce pollution in the city rivers	1993	On-going. Project completion projected 12/31/97
Waste Disposal Project Ln 3830-KO	Expand wastewater treatment capacity in Pusan, and provide specified waste incinerator in Kunsan	1994	On-going. Project completion planned 06/30/99

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Implementation Completion Report

Pusan and Taejon Sewerage Project (Loan 3450-KO)

Table 3: Project Timetable

Steps in project cycle	Date planned	Date actual
Identification	-	10/90
Preparation	01/91	02/91
Appraisal	04-05/91	07/91
Negotiations	01/92	01/92
Board presentation	-	03/26/92
Signing	-	05/21/92
Effectiveness	06/29/92	08/26/92
Project completion	12/31/94	06/31/96
Loan closing	12/31/95	06/30/96

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Implementation Completion Report

Pusan and Taejon Sewerage Project (Loan 3450-KO)

Table 4: Loan Disbursements: Cumulative Estimated and Actual

(US$ Millions)

	FY93	FY94	FY95	FY96	FY97
Appraisal estimate	12.0	34.0	40.0*	40.0**	40.0
Actual	5.9	17.4	25.0	33.5	33.5
Actual as % of estimate	49%	51%	63%	84%	84%

Date of final disbursement: September 19, 1996

* On the request of the Government, US$ 6.0 million was canceled from Category 1 (Pusan component) in July 1994

** On the request of the Government US$ 0.46 million was canceled from Category 2 (Taejon component) in December 1995

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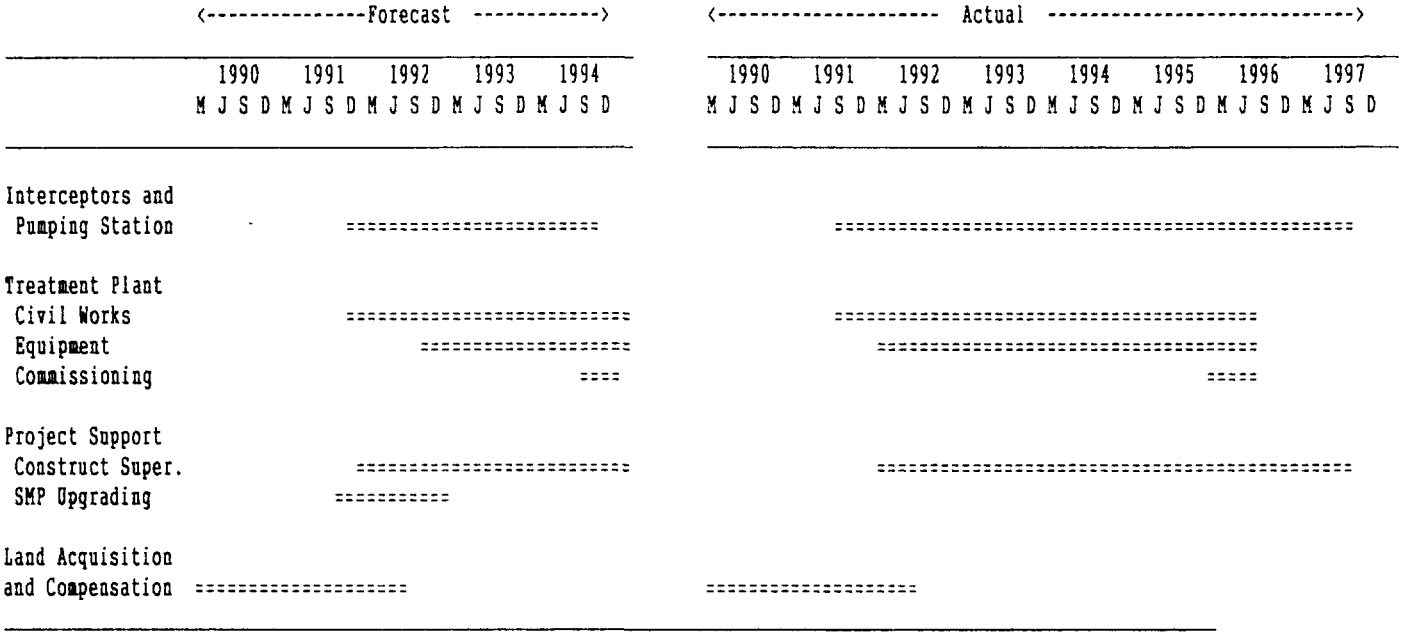
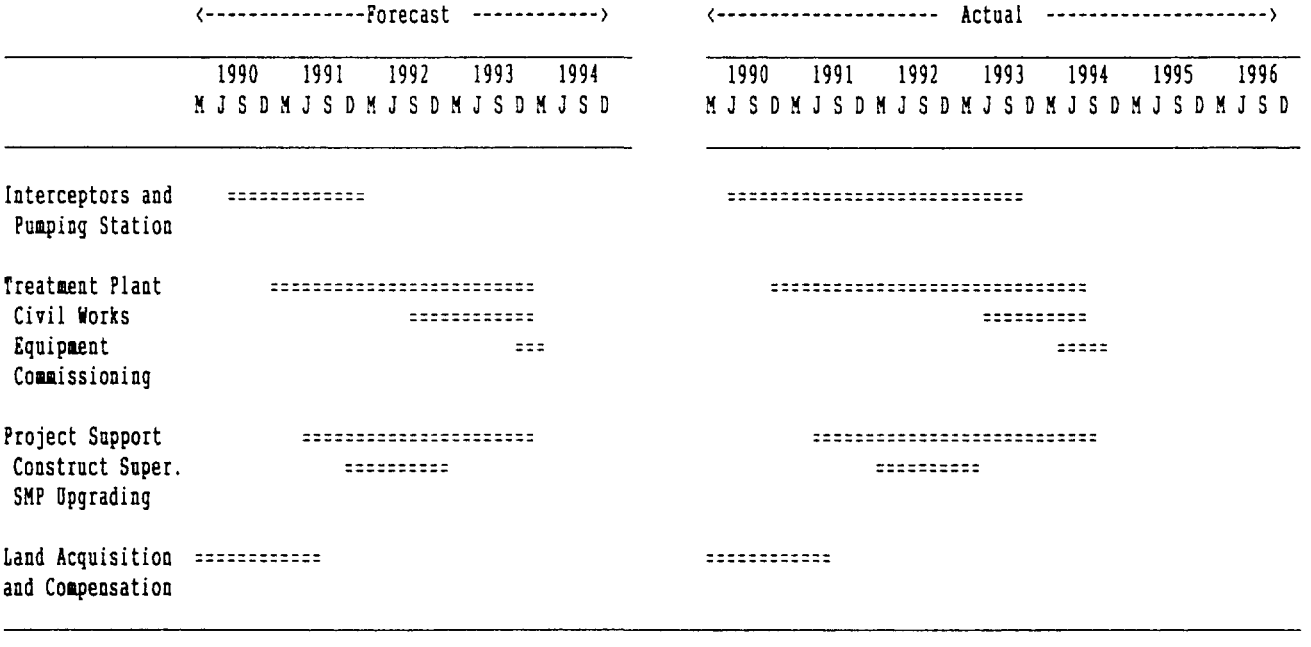
Implementation Completion Report
Pusan and Taejon Sewerage Project (Loan 3450-KO)
Table 5: Key Indicators for Project Implementation
Implementation Schedule - PUSAN COMPONENT



Implementation Schedule - TAEJON COMPONENT



M = Quarter ending March 31
J = Quarter ending June 30
S = Quarter ending September 30
D = Quarter ending December 31

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Implementation Completion Report

Pusan and Taejon Sewerage Project (Loan 3450-KO)

Table 6: Key Indicators for Project Operation

Monitoring Indicators - Pusan Component

	<--------	---- Forecast ------	------>		< ----------	Actual -	---------->		
Year ended December 31	1992	1993	1994	1995	1992	1993	1994	1995	1996
									est.
PHYSICAL PARAMETERS									
Sewage billed 000 m3/y	434728	473505	501402	537772	365468	376059	400859	382921	394584
Sewer connections No.	301249	308441	315806	323346	301249	301260	309067	311195	311598
Length of combined sewer km.	5639	5677	5715	5752	4389	4507	4750	4975	5155
Length of sanitary sewer km.	530	530	530	800	530	530	530	800	820
MANAGEMENT									
Days accounts receivable No.	30	30	30	30	38	40	43	44	43
Employees No.	500	500	500	516	313	308	328	375	401
Employees/1000 connections	1.7	1.6	1.6	1.6	1.0	1.0	1.1	1.2	1.3
FINANCIAL PARAMETERS									
Ave.Sewerage tariff Won/m3	84.26	93.75	93.75	104.06	79.81	78.74	87.84	100.03	134.32
Working ratio	30.0	26.8	27.2	31.4	30.1	27.0	30.8	30.1	35.7%
Rate of return	4.1%	5.0%	5.4%	5.0%	3.1%	1.4%	1.5%	2.2%	2.9%
Contribution to investment	50.2	57.4	49.0	46.3	317.9	43.2	18.4	38.4	24.5%
Debt service ratio	6.7	6.4	5.8	5.3	5.9	4.6	4.0	4.2	3.5
PERFORMANCE OF NAMBU WTP									
Treatment capacity 1000 m3/d	-	-	-	340	-	-	-	-	616
Biochemical Oxygen Demand BOD5 mg/l	-	-	-	30	-	-	-	-	10
Suspended solids mg/l	-	-	-	70	-	-	-	-	5
Phosphorus P mg/l	-	-	-		-	-	-	-	1
Nitrogen N mg/l	-	-	-		-	-	-	-	14

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Implementation Completion Report

Pusan and Taejon Sewerage Project (Loan 3450-KO)

Table 6: Key Indicators for Project Operation

Monitoring Indicators - Taejon Component

	<--------	---- Forecast ------	-------	------->		------ Actual ------	------	------>
Year ended December 31	1992	1993	1994	1995	1992	1993	1994	1995
PHYSICAL PARAMETERS								
Sewage billed 000 m3/y	113056	123960	135324	146964	108518	120415	131772	136957
Sewer connections No.	103566	110847	118640	126981	99584	105846	107669	109902
Length of combined sewer km.	1496	1542	1588	1635	1654	1684	1704	1727
Length of sanitary sewer km.	161	212	263	315				
MANAGEMENT								
Days accounts receivable No.	40	40	40	40	45	36	29	32
Employees No.	125	125	180	180	147	148	188	193
Employees/1000 connections	1.2	1.1	1.5	1.4	1.5	1.4	1.8	1.8
FINANCIAL PARAMETERS								
Ave.Sewerage tariff Won/m3	86.82	109.76	125.58	130.24	72.5	73.1	74.1	78.2
Working ratio	32.2	25.9	31.2	30 5	39.7	37.7	47.1	58.5%
Rate of return	0.8%	3.0%	3.0%	3.0%	-0.6%	-0.5%	-0.7%	-1.6%
Contribution to investment	26.6	47 3	34.9	29.7	11.3	10.8	1.5%	7.0%
Debt service ratio	6.8	9.1	4.2	5.3	3.4	2.5	1.2	1.5
PERFORMANCE OF WONCHON DONG I & II WTPs								
Treatment capacity 1000 m3/d	150	150	300	300	150	150	300	300
Biochemical Oxygen Demand BOD5 mg/l	14	14	14	14	14	16	12	10
Suspended solids mg/l	20	20	20	20	13	15	14	11
Phosphorus P mg/l	-	-	-	-	-	-	2	2
Nitrogen N mg/l	-	-	-	-	-	-	9	8

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Implementation Completion Report

Pusan and Taejon Sewerage project (Loan 3450-KO)

Table 7: Studies Included in Project

Study	Purpose as defined at appraisal	Status	Impact of study
1. Update cities' Sewerage Master Plans (SMP).	Current SMPs were over 10 years old and did not provide details needed to develop the systems. Detailed updating required.	completed on schedule	Updating of both cities' SMPs completed on time using modern computer-based technologies allowing both cities' to upgrade sanitation services.

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Implementation Completion Report

Pusan and Taejon Sewerage Project (Loan 3450-KO)

Table 8A: Project costs: (US$ million)

PUSAN COMPONENT

Item	Appraisal estimate			Actual cost		
	Local	Foreign	Total	Local	Foreign	Total
Treatment plant	66.6	38.1	104.7	57.1	32.1	89.2
Civil works	58.9	9.7	68.6	47.5	8.1	55.6
Equipment	7.7	28.4	36.1	9.6	24.0	33.6
Interceptors	52.7	11.2	63.9	68.6	13.1	81.7
Civil works	52.0	8.5	60.5	61.9	4.0	65.9
Equipment	0.7	2.7	3.4	6.7	9.1	15.8
Project support	1.5	0.1	1.6	4.5	0.2	4.7
Master plan	0.7	0.1	0.8	0.5	0.2	0.7
Supervision	0.8	-	0.8	4.0	-	4.0
Land acquisition	36.4	-	36.4	38.8	-	38.8
Sub total	157.2	49.4	206.6	169.0	45.4	214.4
I.D.C.	4.3	1.5	5.8	4.8	0.8	5.6
Total	161.5	50.9	212.4	173.8	46.2	220.0

TAEJON COMPONENT

Item	Appraisal estimate			Actual cost		
	Local	Foreign	Total	Local	Foreign	Total
Treatment plant	16.7	24.6	41.3	14.9	21.7	36.6
Civil works	10.7	1.8	12.5	8.6	4.2	12.8
Equipment	6.0	22.8	28.8	6.3	17.5	23.8
Interceptors	6.0	1.1	7.1	9.3	0.9	10.2
Project support	1.8	0.1	1.9	1.9	0.1	2.0
Master plan	0.7	0.1	0.8	0.9	0.1	1.0
Supervision	1.1	-	1.1	1.0	-	1.0
Land acquisition	7.8	-	7.8	7.8	-	7.8
Sub total	32.3	25.8	58.1	33.9	22.7	56.6
I.D.C.	0.9	0.7	1.6	0.9	1.1	2.0
Total	33.2	26.5	59.7	34.8	23.8	58.6

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Implementation Completion Report

Pusan and Taejon Sewerage Project (Loan 3450-KO)

Table 8A: Project costs (US$ million)

COMBINED PUSAN AND TAEJON COMPONENTS

Item	Appraisal estimate			Actual cost		
	Local	Foreign	Total	Local	Foreign	Total
Treatment plant	83.3	62.7	146.0	72.0	53.8	125.8
Civil works	69.6	11.5	81.1	56.1	12.3	68.4
Equipment	13.7	51.2	64.9	15.9	41.5	57.4
Interceptors	58.7	12.3	71.0	77.9	14.0	91.9
Civil works	58.0	9.6	67.6	71.2	4.9	76.1
Equipment	0.7	2.7	3.4	6.7	9.1	15.8
Project support	3.3	0.2	3.5	6.4	0.3	6.7
Master plan	1.4	0.2	1.6	1.4	0.3	1.7
Supervision	1.9	-	1.9	5.0	-	5.0
Land acquisition	44.2	-	44.2	46.6	-	46.6
Sub total	189.5	75.2	264.7	202.9	68.1	271.0
I.D.C.	5.2	2.2	7.4	5.7	1.9	7.6
Total	194.7	77.4	272.1	208.6	70.0	278.6

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Implementation Completion Report
Pusan and Taejon Sewerage Project (Loan 3450-KO)
Table 8B: Project Financing (US$ million)

PUSAN COMPONENT

Source	Appraisal estimate			Actual		
	Local	Foreign	Total	Local	Foreign	Total
IBRD Loan	-	20.0	20.0	-	13.5	13.5
Regional Development fund	29.2	-	29.2	36.0	-	36.0
City's General account	23.6	30.8	54.4	6.2	32.7	38.9
EMC loan	-	-	-	23.7	-	23.7
Internal cash generation	108.3	-	108.3	107.9	-	107.9
Total	161.1	50.8	211.9	173.8	46.2	220.0

TAEJON COMPONENT

Source	Appraisal estimate			Actual		
	Local	Foreign	Total	Local	Foreign	Total
IBRD Loan	-	20.0	20.0	-	19.5	19.5
Regional Development fund	11.1	-	11.1	9.3	-	9.3
City's General account	3.5	6.5	10.0	6.0	4.3	10.3
Central government	5.3	-	5.3	9.2	-	9.2
Internal cash generation	13.8	-	13.8	10.3	-	10.3
Total	33.7	26.5	60.2	34.8	23.8	58.6

COMBINED PUSAN AND TAEJON COMPONENTS

Source	Appraisal estimate			Actual		
	Local	Foreign	Total	Local	Foreign	Total
IBRD Loan	-	40.0	40.0	-	33.0	33.0
Regional Development fund	40.3	-	40.3	45.3	-	45.3
Cities' General account	27.1	37.3	64.4	12.2	37.0	49.2
Central government	5.3	-	5.3	9.2	-	9.2
EMC Loan	-	-	-	23.7	-	23.7
Internal cash generation	122.1	-	122.1	118.2	-	118.2
Total	194.8	77.3	272.1	208.6	70.0	278.6

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Implementation Completion Report

Pusan and Taejon Sewerage Project (Loan 3450-KO)

Table 9: Economic Costs and Benefits

CALCULATION OF FINANCIAL RATE OF RETURN
SUPPORTING DATA

	Pusan	Taejon
Investment Cost excluding Taxes and Land Acquasition/Compensation	Won Million	Won Million
Treatment Plant		
Civil Works	40837	8834
Equipment	21747	16426
Interceptor & Pumping Station	62934	7040
Project Support TA		
Construction Supervision	1888	690
Total Investment	127406	32990
Phasing of Annual Investment:	%	%
Year 1	0	19
2	8	18
3	26	31
4	19	32
5	23	0
6	12	0
7	12	0
Total	100	100

NOTES TO FINANCIAL RATE OF RETURN CALCULATION

The project life is assumed to be 40 years for both cities.

The ROR in Taejon is assumed to be 1.0% in 1999 and thereafter.

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Implementation Completion Report
Pusan and Taejon Sewerage Project (Loan 3450-KO)
Table 9: Economic Costs and Benefits

CALCULATION OF FINANCIAL RATE OF RETURN
PUSAN COMPONENT (Million Won)

YEAR	<- -OUTFLOWS- -> INVEST.	O & M	<- - - - - -INFLOWS - - - - - -> O & M	DEPR.	R.O.R.	TOTAL	NET FLOW
-4	0						0
-3	10192						-10192
-2	33126						-33126
-1	24207						-24207
1	29303	2867	2867	3185	3695	9747	-21914
2		2867	2867	3185	3695	9747	7390
3		2867	2867	3185	3695	9747	7390
4		2867	2867	3185	3695	9747	7390
5		2867	2867	3185	3695	9747	7390
6		2867	2867	3185	3695	9747	7390
7		2867	2867	3185	3695	9747	7390
8		2867	2867	3185	3695	9747	7390
9		2867	2867	3185	3695	9747	7390
10		2867	2867	3185	3695	9747	7390
11		2867	2867	3185	3695	9747	7390
12		2867	2867	3185	3695	9747	7390
13		2867	2867	3185	3695	9747	7390
14		2867	2867	3185	3695	9747	7390
15		2867	2867	3185	3695	9747	7390
16		2867	2867	3185	3695	9747	7390
17		2867	2867	3185	3695	9747	7390
18		2867	2867	3185	3695	9747	7390
19		2867	2867	3185	3695	9747	7390
20		2867	2867	3185	3695	9747	7390
21		2867	2867	3185	3695	9747	7390
22		2867	2867	3185	3695	9747	7390
23		2867	2867	3185	3695	9747	7390
24		2867	2867	3185	3695	9747	7390
25		2867	2867	3185	3695	9747	7390
26		2867	2867	3185	3695	9747	7390
27		2867	2867	3185	3695	9747	7390
28		2867	2867	3185	3695	9747	7390
29		2867	2867	3185	3695	9747	7390
30		2867	2867	3185	3695	9747	7390
31		2867	2867	3185	3695	9747	7390
32		2867	2867	3185	3695	9747	7390
33		2867	2867	3185	3695	9747	7390
34		2867	2867	3185	3695	9747	7390
35		2867	2867	3185	3695	9747	7390
36		2867	2867	3185	3695	9747	7390
37		2867	2867	3185	3695	9747	7390
38		2867	2867	3185	3695	9747	7390
39		2867	2867	3185	3695	9747	7390
40		2867	2867	3185	3695	9747	7390
					FINANCIAL RATE OF RETURN %		6.98
							=====

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Implementation Completion Report
Pusan and Taejon Sewerage Project (Loan 3450-KO)
Table 9: Economic Costs and Benefits
CALCULATION OF FINANCIAL RATE OF RETURN
TAEJON COMPONENT (Million Won)

YEAR	<- -OUTFLOWS- -> INVEST.	O & M	<- - - - - - INFLOWS - - - - - -> O & M	DEPR.	R.O.R.	TOTAL	NET FLOW
-4	6268						-6268
-3	5938						-5938
-2	10227						-10227
-1	10557						-10557
1	0	587	587	825	-165	1247	-330
2		587	587	825	0	1412	0
3		587	587	825	165	1577	330
4		587	587	825	330	1742	660
5		587	587	825	495	1907	990
6		587	587	825	495	1907	990
7		587	587	825	495	1907	990
8		587	587	825	495	1907	990
9		587	587	825	495	1907	990
10		587	587	825	495	1907	990
11		587	587	825	495	1907	990
12		587	587	825	495	1907	990
13		587	587	825	495	1907	990
14		587	587	825	495	1907	990
15		587	587	825	495	1907	990
16		587	587	825	495	1907	990
17		587	587	825	495	1907	990
18		587	587	825	495	1907	990
19		587	587	825	495	1907	990
20		587	587	825	495	1907	990
21		587	587	825	495	1907	990
22		587	587	825	495	1907	990
23		587	587	825	495	1907	990
24		587	587	825	495	1907	990
25		587	587	825	495	1907	990
26		587	587	825	495	1907	990
27		587	587	825	495	1907	990
28		587	587	825	495	1907	990
29		587	587	825	495	1907	990
30		587	587	825	495	1907	990
31		587	587	825	495	1907	990
32		587	587	825	495	1907	990
33		587	587	825	495	1907	990
34		587	587	825	495	1907	990
35		587	587	825	495	1907	990
36		587	587	825	495	1907	990
37		587	587	825	495	1907	990
38		587	587	825	495	1907	990
39		587	587	825	495	1907	990
40		587	587	825	495	1907	990
			FINANCIAL RATE OF RETURN %				0.41
							====

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Implementation Completion Report

Pusan and Taejon Sewerage Project (Loan 3450-KO)

Table 10: Status of Legal Covenants

Agreement	Covenant type	Present status	Description of covenant	Comments
A. Loan Agreement				
2.02(b)	3	C	Borrower to open and maintain in dollars a Special Account	complied
3.01(b)	3	C	Borrower to re-lend US$20 million each to Pusan and Taejon under Subsidiary Loan Agreements	complied
3.02	3	C	Procurement of goods to be governed by Schedule 4 of the Loan Agreement	complied
4.01(a)	1	C	(i) both cities to maintain records to reflect operation of Statement of Expenditure account	complied
4.01(b)	1	C	(i) IBRD Special Accounts and operating accounts to be audited each year for Pusan and Taejon	complied
			(ii) furnish audit reports not later than 6 months after end of each FY	complied
B. Project Agreements. Part A. Pusan City Government; Part B. Taejon City Government				
2.01(b)2	13	C	Complete updating of sewerage master plans	complied
2.01(b)3	6	C	Furnish & implement environmental monitoring program	complied
2.01(b)4a	9	C	Furnish semi-annual progress reports	complied
2.01(b)4b	2	CP	Furnish financial projections	partially complied
3.02(a)	2	NC	From 1993 achieve annual rate of return of at least 5% Pusan and 3% Taejon	ROR achieved Pusan Taejon '93 1.4% -.5% '94 1.5% -.7% '95 2.2% -1.6%
3.03	10	C	Both city's sewerage division's fixed assets to be revalued.	Revaluation done in 1993

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Table 10: Status of Legal Covenants

Present Status Codes

C	=	covenant complied with
CP	=	complied with partially
NC	=	not complied with

Covenant Types

1	=	accounts/audits
2	=	financial performance/revenue generation from beneficiaries
3	=	flow and utilization of project funds
6	=	environmental covenants
9	=	monitoring, review and reporting
10	=	project implementation not covered by categories 1-9
13	=	other

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Table 11: Bank resources: staff inputs

Stage of project cycle	Planned No.of weeks	Actual No. of weeks	Actual Staff costs US$'000s
Through appraisal	n.a	70.2	212.3
Board approval	n.a	4.8	17.1
Supervision	40.0	27.8	100.4
Completion	4.0	8.1	34.8
TOTAL	n.a	110.9	364.6

n.a. = not available

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Table 12: Bank Resources: Missions

Stage of Project cycle	month/ year	No. of pers.	days in field	Specialized staff skills represented	Performance Rating Implement. Status	Develop- ment	Type of problems
Identification Pre-appraisal	10/90 07/91	5	25	Sanitary Engineers Environmental Spec. Financial Analysts	n.a	n.a	
Appraisal Board approval	05/92	4	0	Project, loan & legal officers Engineers	n.a	n.a	
Super- vision	06/93	2	5	Sanitary Engineer Financial Analyst	1	1	Delay in Pusan due to nego- tiations with NGOs. Failed to reach ROR targets as no tariff increase.
	03/94	3	7	Sanitary Engineer Environmental Spec. Financial Analyst	2	2	Failed to reach ROR targets as no tariff increase.
	06/95	1	7	Sanitary Engineer	HS	HS	
Pre-Comple- tion	11/95	2	14	Financial analysts	HS	HS	Loan closing date extended
Comple- tion	11/96	2	5	Financial analysts	S	S	

Note: The supervision missions ratings were high although one financial covenant relating to rate of return was not complied with. Failure to achieve this rate of return did not affect the implementation of the project, and did not reduce in any way the expenditure on system operation and maintenance. The shortfall in revenues was made up from equity contributions from the cities' general accounts, and from local borrowing.

APPENDIX A

AIDE MEMOIRE

November 25, 1996

Pusan and Taejon Sewerage Project
(Loan No. 3450-KO)

1. A World Bank Project Completion Mission visited Korea from November 21 to 25, 1996 to obtain the views of the borrower and the implementing agencies on the implementation process, discuss the borrower's responsibilities in preparing implementation completion reporting, and to collect additional data for the preparation of the Implementation Completion Report (ICR). The mission is grateful for the cooperation and assistance received.

2. The Pusan and Taejon Project (Loan No. 3450-KO), in the amount of US$ 40 million, was approved by the Board on March 26, 1992, and declared effective on August 26, 1992. An amount of US$ 6 million was canceled in July 1994 by Pusan due to lower than expected civil works costs coupled with the elimination of the booster pumping station. An amount of US$ 0.4 million was also canceled by Taejon in December 1995. The loan closing date was originally planned for December 31, 1995, but due to the delay in completion of the Pusan component the Government requested an extension of the closing date to June 30, 1996, which was approved by the Bank.

Pusan component

3. In Pusan, the project consisted of the construction of the first phase of the Nambu wastewater treatment plant (WTP), sewer interceptors and a tunnel. The WTP had to be partially redesigned due to objections from neighboring NGOs, and new bidding delayed the construction. Civil works on the WTP was completed in June 1996, and construction of the sea outfall and outlet is expected to be completed by October 1997.

4. The Sewerage Management Office provided the mission with its evaluation on the implementation of the Pusan component, which covered project execution, cost benefits, Bank's and borrower's performance, and the city's commitment to the project's objectives.

Taejon component

5. In Taejon, the project consisted of the construction of the second phase of the Wonchon Dong WTP, plus the construction of sewer interceptors. Construction was completed in January 1994; test operations commenced in February 1994, and were completed in July 1994.

6. In November 1995, the Taejon Sewerage Division provided the Bank with its evaluation report on the implementation of the Taejon component.

Project summary

7. Project implementation of both components was satisfactory and the achievements are expected to be fully sustainable. The environmental monitoring program is in progress. The financial performance of both sewerage divisions during implementation has been disappointing due to the delay in increasing sewerage tariffs, and the rates of return covenants in the project agreements have not been achieved.

8. Compliance with all other major covenants has been satisfactory.

APPENDIX B

BORROWER'S CONTRIBUTION

PUSAN SEWERAGE MANAGEMENT OFFICE

PUSAN

THE EVALUATION REPORT

Project Name : Pusan Nambu Sewage Treatment Facility

Loan : 3450-KO

1. Component Objectives

(1) Improvement of sewer water quality

(2) Improvement of urban environment in accordance with water quality improvement

(3) Marine resource protection in accordance with coastal area water pollution prevention

(4) Improvement of water pollution conditions of Yongho Bay and its surrounding areas

2. Achievement of the Component Objectives

(1) Improvement of the existing pleasant urban environment of the city

(2) Water quality improvement of Dongchun, Port of Pusan, and Kwanganli Beach

(3) Supplementation of the green area of the city with park formation of the upper portion of the sewage treatment facility

(4) Increase the added value of land usage

3. Implementation Record and Minor Factors Affecting the Component

With the final project completion year set at 2011, the total treatment area is 43.88 km2 comprised of the Pusanjin region centering around Dongchun, Daeyoun region, Yongho region, and part of the Dong-ku and Nam-ku regions. The

Dongchun Basin, Daeyoun, Yongho and part of the Nam-ku region (Namchun and Kwangan) have been designated as Treatment Project #1, and a facility with the daily sewage treatment capacity of 340,000 m3 will be established in this region by 1996. At the second phase of this project, the treatment capacity will increase by 244,000 m3 per day totaling 584,000 m3 per day with 1,084,000 people in the year 2011. This value will be under the standard water quality value as determined by the Environmental Protection Law for Discharged Water.

The "Standard Sludge Activation Method" will be used for the treatment, and the sludges produced during the treatment process, will be handled through the existing Sludge Treatment Facility. The construction plan for the second stage of the project will require sufficient preparation in advance such as reviewing various other plans with different views.

The project summary for the Nambu Sewage Treatment Facility and the construction of the interceptor are as follows:

(1) Anticipated Region and Population Handled

Anticipate Region : 25,366 km2

Population Handled : 800,000 persons

(2) Anticipated Treatment Volume

Classification		Phase #1	Final Phase
Completion Year		1996	2011
Anticipated Sewer Volume (m3/d)	Daily Average	278,000	486,000
	Daily Maximum	340,000	584,000
	Hourly Maximum	492,000	839,000

(3) Planned Water Quality and Discharged Water Quality

Planned Water Quality	: BOD 180 mg/l	SS 210 mg/l
Discharged Water Quality	: BOD 18 mg/l	SS 19 mg/l

(4) Treatment Method

Standard Sludge Activation method (Deep Aeration Method)

(5) Location of the Treatment Facility and Area of Lot

Location of the Treatment Facility : 30, Yongho-dong, Nam-ku

Pusan

Area of Lot : 125,953 m2 (about 38,100 pyung)

(6) Discharging Route : Down the Yongho River

4. Bank Performance

An assessment of the Bank's performance is satisfactory in component identification, preparation assistance, appraisal, and supervision, but deficient in disbursement from the loan during the construction.

5. Borrower Performance

The performance of the borrower is very satisfactory in terms of preparation, execution, and operation of the project.

6. Assessment of Outcome

This project began with the Korean Government's loan request to IBRD for the sewage treatment project. The fundamental objective of this project is in improving the water quality of the daily urban sewers and waste waters flowing into the rivers and coastal region. the surveying and planning of the project was entrusted to a consulting company by the City of Pusan, and approved by the Ministry of Construction with the overall supervision of the project done by a

group of supervisors. The construction and supervision were performed by Hyundai Precision Industries Ltd. and the Supervisors of the City of Pusan respectively to accommodate the needs of the project at hand.

7. Future Operation

This treatment facility has been operating at a value lower than the standard environment values since the pre-construction stage after analyzing the aftermath of the environment, and the Roots Blower that has been used as the oxygen supplying device at the aeration facilities has been replaced by a Turbo Blower in order to treat the sewer more efficiently, and improve the operation of the aeration tank which is the most important element in treating waste waters. The Turbo Blower is more effective, has the ability to control the volume of air automatically at ease, and has a longer life cycle.

The ventilation and Deodorizing Facility has also been installed around the treatment facility to reduce and prevent the odors and air pollution from being produced at the time of the treatment process. By installing the Centrifugal Thickener at the treatment facility for the first time in Korea to reduce sludges which are pollutants, and promote efficient treatment, costs have decreased.

Automatic measuring devices of essential elements for the water quality improvements have prevented the spoilage of water in advance. In addition, the building of a roof on the facility and using it as a welfare facility has promoted public welfare of the region which indicates a new function for the sewage treatment facility. This new function gives a glimpse of the future of the facility. However, the incineration of the sludge or the installation of manure manufacturing facility can be taken into consideration as a positive

measure for environmental protection for the future.

8. Key Lessons Learned

This project was planned and analyzed carefully in advance by the City of Pusan by taking into consideration the increase of sewage volume following the population increase in the future. The lessons learned are the construction of a treatment facility to accommodate such increases to reduce operation costs, the ability to fully utilize the space that is smaller than other treatment facilities in Korea, and the formation of the treatment facility into a park. The investment of the Sludge Central Concentration Facility at the sewage treatment facilities of Korea is notable as concern towards the future environment.

APPENDIX C

BORROWER'S CONTRIBUTION

TAEJON SEWERAGE DIVISION

TAEJON COMPONENT

THE EVALUATION REPORT

Project Name : Taejon Sewerage Project

Loan No : 3450 - KO

1995.11

TAEJON CITY

1. Component Objectives

Taejon City carries out the sewerage project based on the Master Plan established in 1982 in order to prevent environmental pollution which would result from rapid population growth and industrial development, and has already constructed and operated a sewage treatment plant with a capacity of 150,000 m3/day.

In the late 1980's, Taejon City enlarged its administrative area and Taedok Science Town was developed within the city. Eventually, Taejon City was promoted to the Great City as of First of January in 1989. As a result, since the existing sewerage master plan becomes unsuitable for the present situation, its amendment is required. Based on the amended master plan, the second phase construction project of Taejon Sewage Treatment Plant is initiated.

The project encompasses the preliminary and detailed engineering works for the extension of the sewage treatment plant with a capacity of 150,000 m3/day and thus it shall provide the citizens with a healthy environment resulting from the improvement of water quality of receiving water bodies, the Kap-chon and Kum-gang rivers.

2. Achievement of Component Objectives

Indirect and direct benefits of this project are expected as follows:-

2.1 Indirect Benefit

1) Preservation of aquatic resources by water quality improvement
2) Improvement of living environment and public health
   - Decrease of occurrence of water born diseases
3) Improvement of city aesthetic view
4) Rise of cost and added values of land
5) Increase of ratio served by flushing toilet
   - Improvement of treatment efficiency and saving of O & M cost of the nightsoil treatment plant
6) Exemption of installation of septic tanks or sewage clarifying facilities
   - Saving of construction, O & M, and collection costs
7) Improvement of function as an educational or cultural city.

2.2 Direct benefit

1) By-products

   A by-product in the sewage treatment plant is biogas or methane gas produced by anaerobic digestion of sludge.

2) Saving of construction cost of the nightsoil

   Treatment plant Treatment of 200 kl/d septage by sludge treatment facilities in the sewage treatment plant will result in the cost saving of an additional nightsoil treatment plant.

3) Saving of medical expenses for public health

   Saving of parasiticide expenses

The sanitary treatment of nightsoil will benefit public health of Taejon citizens not by taking parasiticide.

4) Increase of employment (manpower for construction and O & M of the sewage treatment plant)

5) Improvement of water quality of receiving bodies.

3. Implementation Record and Major Factors Affecting the Component

The daily maximum design sewage flow is 150,000 m3/day. When wet season, incoming sewage flow is estimated to be 288,000 m3/day through interceptors, and the excess flow is designed to be discharged directly to the Kap-cheon river only after primary treatment and chlorination.

Industrial wastewater is mixed with domestic sewage and treated in the plant. The sewage treatment process is a secondary treatment process with a traditional activated sludge, and the sludge is digested by anaerobic process and is then dewatered by mechanical means.

Methane gases which are by-products during sludge digestion process are used as fuel of gas generators. This electric power is supplied to the air blowers which require electric power most of all electrical equipments.

The second phase treatment plant is located at Wonchon - dong, Yusong ku which is the same site of the existing first phase one.

In the amended sewerage master plan describes the construction plan of sewage treatment plants as the following <TABLE 1>

<TABLE 1> CONSTRUCTION PLAN OF SEWAGE TREATMENT PLANT

Category	1st Phase	2nd Phase	3rd Phase	4th Phase
Target Year	1989	1991	1996	2001
Planning Area (km3)	22.15	47.23	74.80	96.50
Planned Pop. (persons)	404,400	756,000	1,269,600	1,517,100
Design flow (m3/day)	150,000	300,000	600,000	830,000
Sewage Treatment Process	Activated Sludge	Activated Sludge	Activated Sludge	Activated Sludge
Sludge Treatment Process	Anaerobic Digestion	Anaerobic Digestion	Anaerobic Digestion	Anaerobic Digestion
Plant Area (m3)	93,800	64,019	170,000	130,000
Influent Quality (mg/l)	BOD 170	140	147	156
	SS 180	118	123	132
Design Influent	BOD170(200)	160(190)	160(190)	160(190)
Quality (mg/l)	SS 180(200)	140(160)	140(160)	140(160)
Effluent Quality (mg/l)	BOD 30	26	26	26
	SS 30	24	24	24
Treatment Efficiency(%)	BOD 85	86	86	86

Notes:
1) Values in the upper categories including those of all previous phases.
2) Values in the parenthesis of the design influent quality represent the concentration of sewage quality after being mixed with return activated sludge.

4. Bank Performance

An assessment of the Bank's performance are satisfactory in component identification, preparation assistance, appraisal, and supervision.

5. Borrower Performance

As assessment of the performance of the borrower and implementing agencies are highly satisfactory in preparing, implementing, and where relevant, operating the project or component.

6. Assessment of Outcome

Taejon city government receive loan from IBRD to supply good quality of domestic, industrial and agricultural mater through improving living environment, public hygiene and sanitation as well as preserving water resources.

Taejon City government give basic plan and detailed design to Engineering Company, receive admission from Ministry of Construction and complete this project with management of supervision group.

This project completed successfully, having with help of Taejon city, good experience on design and supervision of Supervision Group, and a lot of experience of Sambu-Togeon Construction Company to reach the objectives of this project.

7. Future Operation

The operation of 2nd Phase of Taejon STP have to be made under environmental standard, after impact and before construction is estimated.

We control blowing air with speed controller of measuring DO in aerator, and make it automated and check by time concentration indication etc. in primary,final settling tank and thickener. So we can get effects to minimize cost and operate efficiently.
We estimate impacts before and after operation in the air quality, water quality, noise, odor etc.

We install FRP covers in thickener and digested sludge thickener for deodorization.

Existing STP are operating by conventional central control system, but this STP will install distributed control system, therefore we can monitor and control between center and field.

8. Key Lessons Learned

This project reflect increase of industrial and domestic wastewater because there is fast increase of population for optimum characteristic of Taejon City in which will be opened Taejon Expo, and have Daeduck Research Institute as well as updated industrial and technical complex.
It is outstanding that Taejon city reduce cost for construction and operation, improve living environment, minimize adverse impact for environment, and make STP coexist in surrounding Expo Apt. and research institute.

APPENDIX D

BORROWER'S COMMENTS

ON THE ICR

)-08-96 SUN 21:30 OXFORDPALACEHOTEL FAX NO. 2133823434 P. 01

Mr. Anjum Altaf
Environment Economist
Infrastructure Operations Division
Country Department I, East Asia and Pacific Region
The World Bank
1818 H St., N.W.
Washington, D.C. 20433 U.S.A.

December 8, 1996

Mr AA

Dear Mr. Altaf:

Further to our discussion on the Implementation Completion Report (ICR) of the Pusan and Taejon Sewerage Project, I would like to inform you that I have no comments on the ICR prepared by EA1IN. I would note, however, that economic and sociopolitical circumstances surrounding the implementation of the project have well been reflected in the report.

I would like to take this opportunity to express my deep appreciation in the capacity of Deputy Director of the Korea Ministry of Finance and Economy to all the Bank staff involved for the timely and thoughtful guidance conducted towards the successful completion of the project. I am also grateful to you and your colleagues for the hospitality unfolded to us during our recent mission to the Bank.

Please feel free to contact me if you have any assistance from me associated with any on-going Bank projects.

Sincerely yours,

Geum-Nam Kim
Deputy Director
Treasury Division
The Ministry of Finance and Economy
Tel.: (82-2) 503-92801~1
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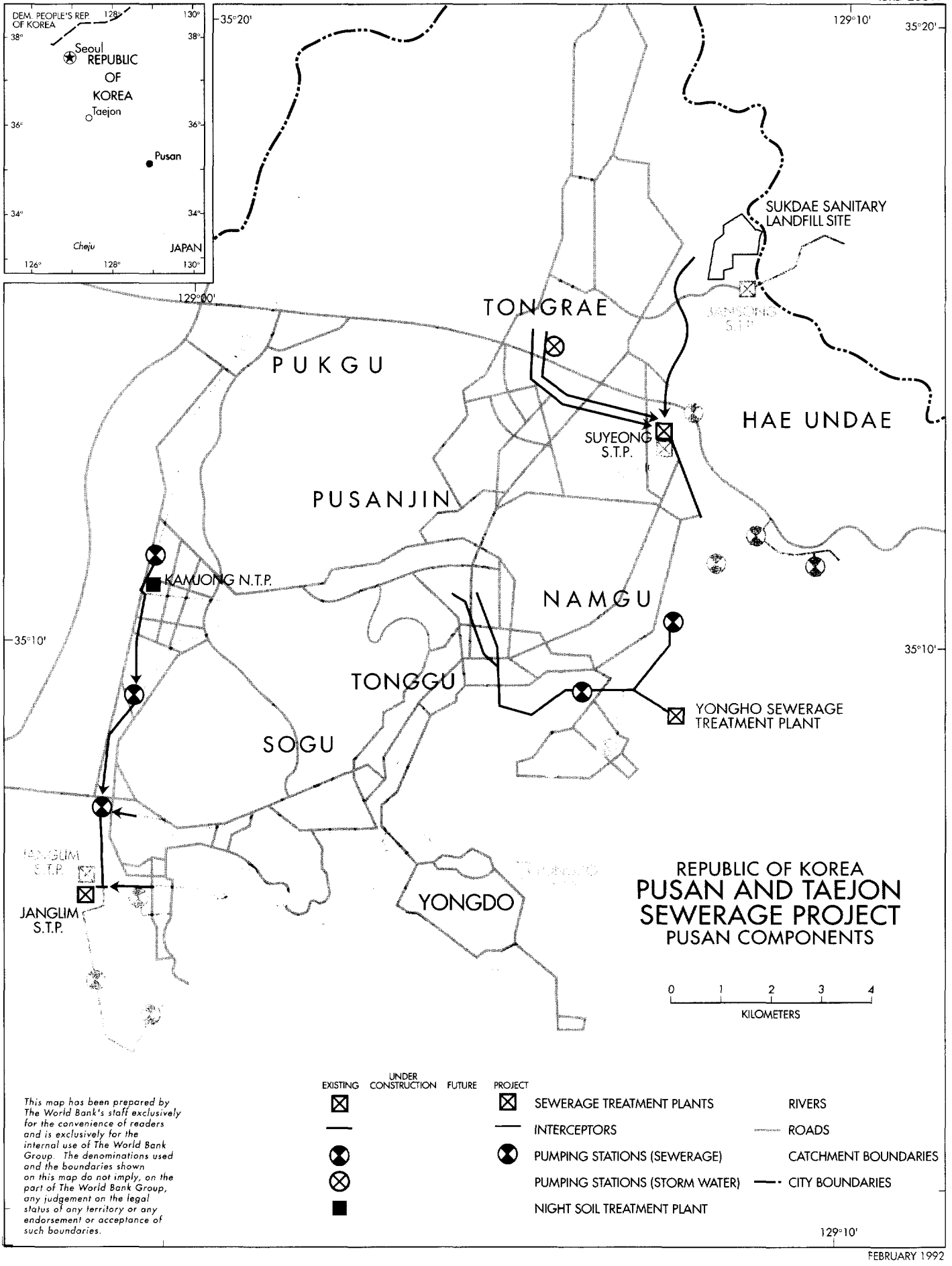
IBRD 23319



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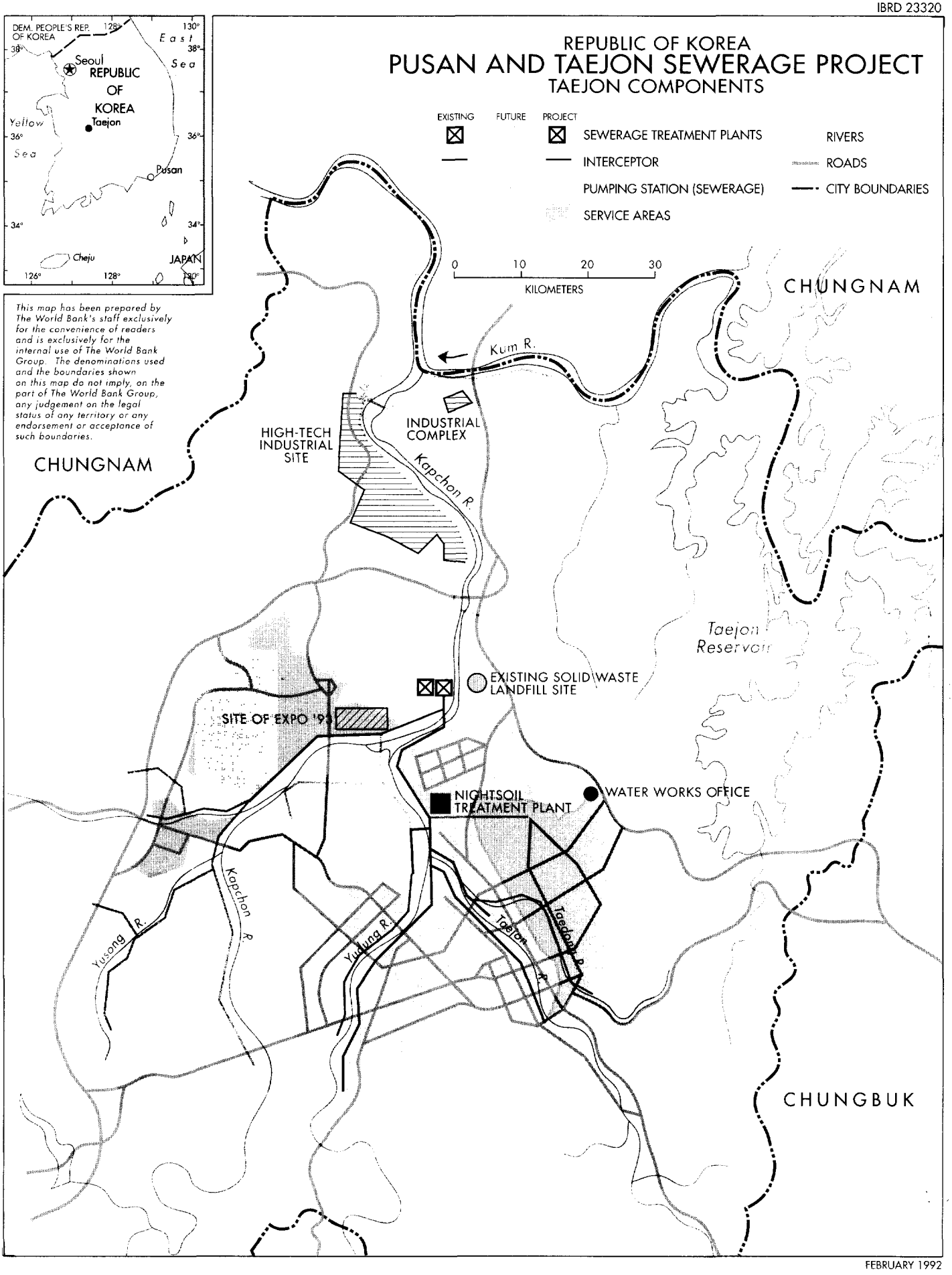

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